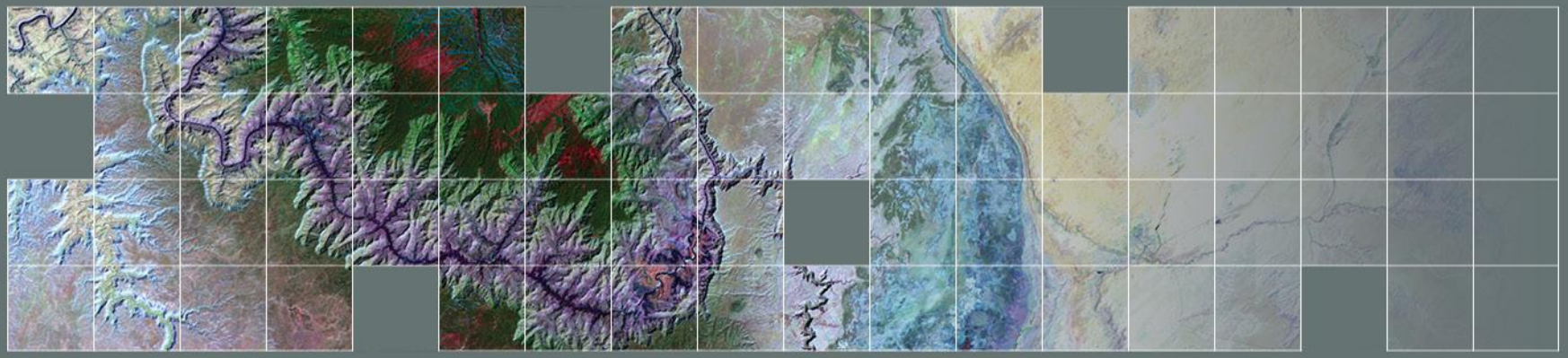
USGS
science for a changing world

Climate and Land Use Change
Earth Resources Observation and Science (EROS) Center

Status of Landsat Science Products



John Dwyer
October 31, 2013

U.S. Department of the Interior
U.S. Geological Survey

Science Products Under Development

- Top of Atmosphere Reflectance
- ✓ Surface Reflectance
- Surface Temperature
- Burned Area – Provisional Q1 CY14
- Surface Water - Provisional Q1 CY14
- Fractional Snow Covered Area
- Global 30m Land Cover - Provisional Q1 CY14

Landsat Science Team participation in product evaluation will be solicited.

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TOA Reflectance Products

There are conceivably 3-4 methods by which the TOA reflectance product can be generated in terms of the solar zenith angle correction:

1. **Assume a solar zenith angle of zero, effectively no correction (TOA r')**
2. **Assume a single, scene center based solar zenith angle (TOA r)**
3. **Calculate and correct a pixel-based solar zenith angle**
   - Provide this solar zenith angle band with the data so that users can back this out if desired.
   - Provide solar zenith angle, solar azimuth angle, sensor (view) zenith angle, and sensor (view) azimuth angle bands with the data so that users can back this out if desired.

Sample products available for evaluation at:

http://edclpdsftp.cr.usgs.gov/landsat_product_examples/

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Surface Reflectance

- EROS Science Processing Architecture (ESPA)
- Released through Earth Explorer May 2013
- CFmask (cloud, shadow)
- LEDAPS 1.3.0 July 31, 2013
- Landsat 4 and 5 TM, Landsat 7 ETM+
- ESPA, LEDAPS, and Cfmask code available through Google Projects

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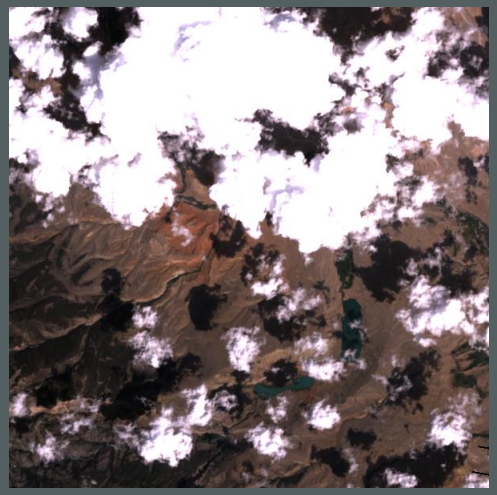
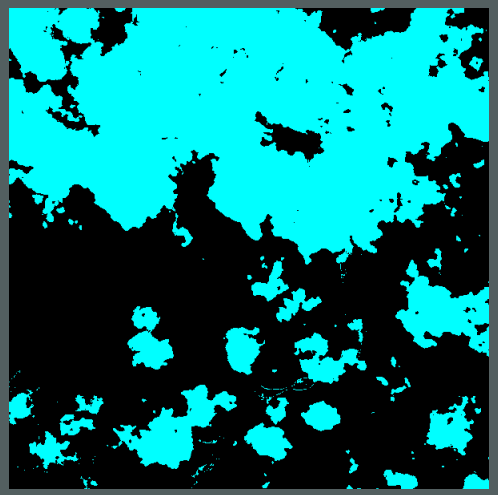
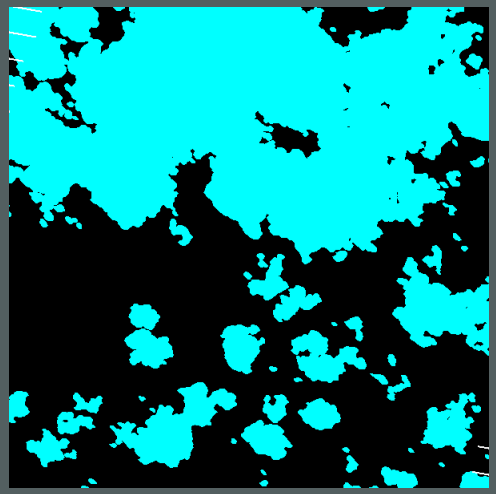
Surface Reflectance Example



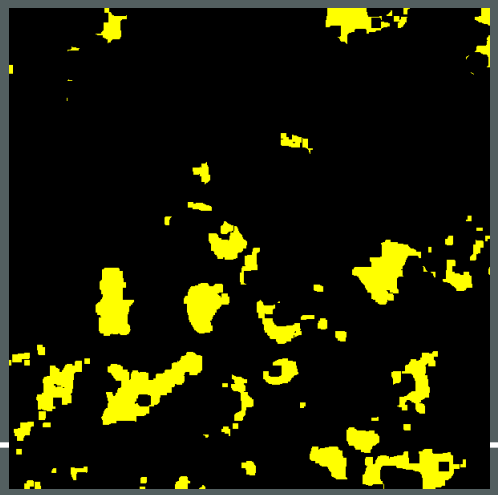


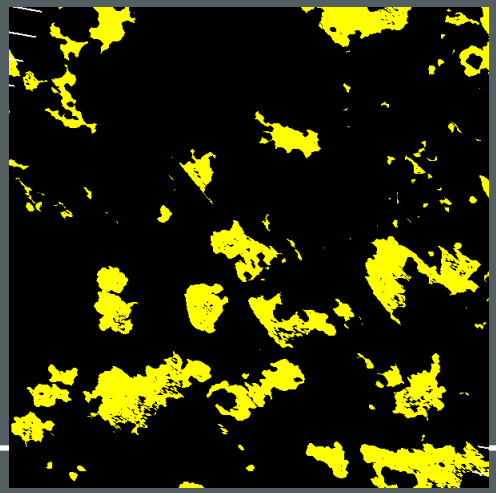
LEDAPS cloud_QA



CFmask Cloud

LEDAPS cloud shadow_QA





CFmask Cloud Shadow

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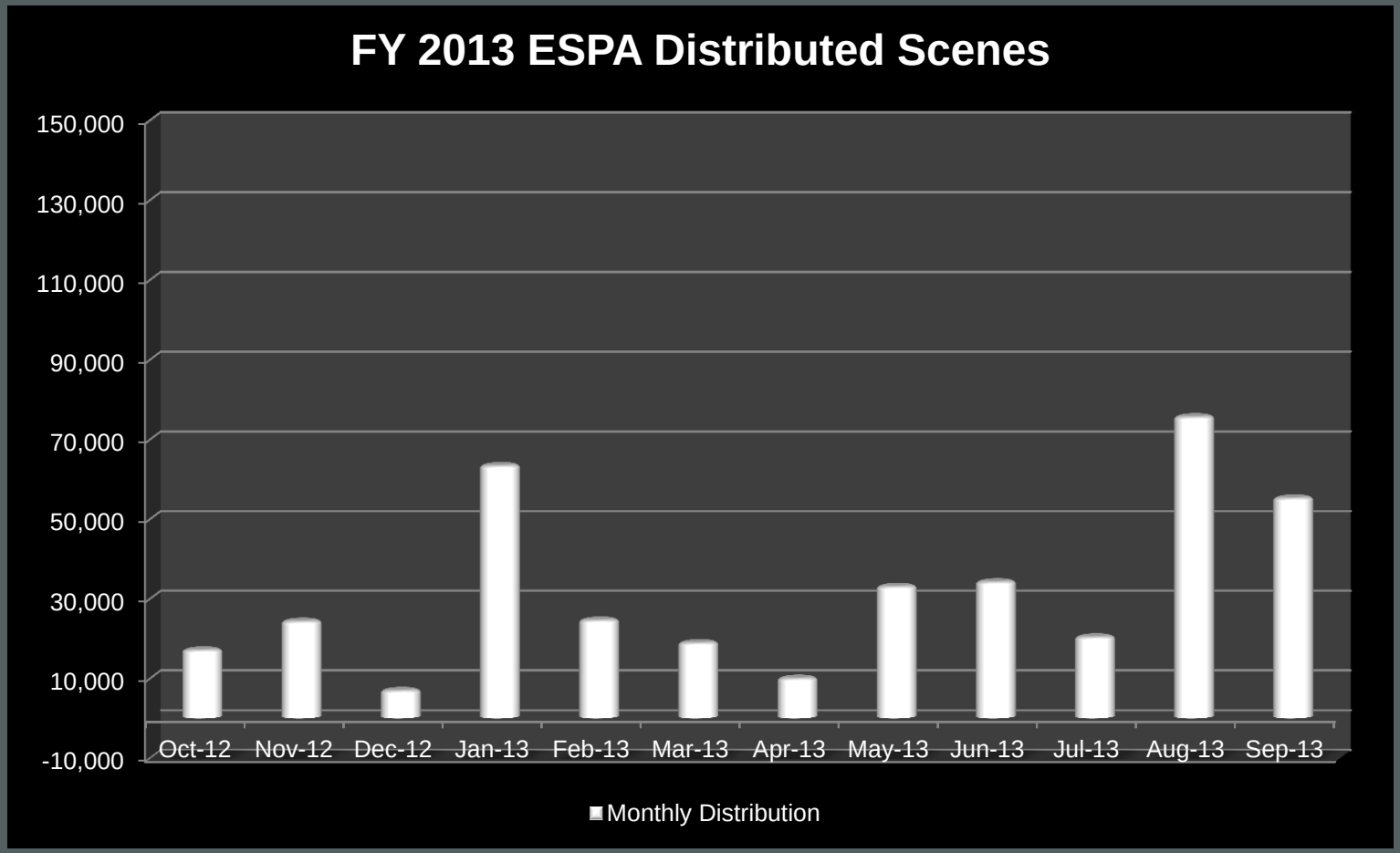
Surface Reflectance Distribution



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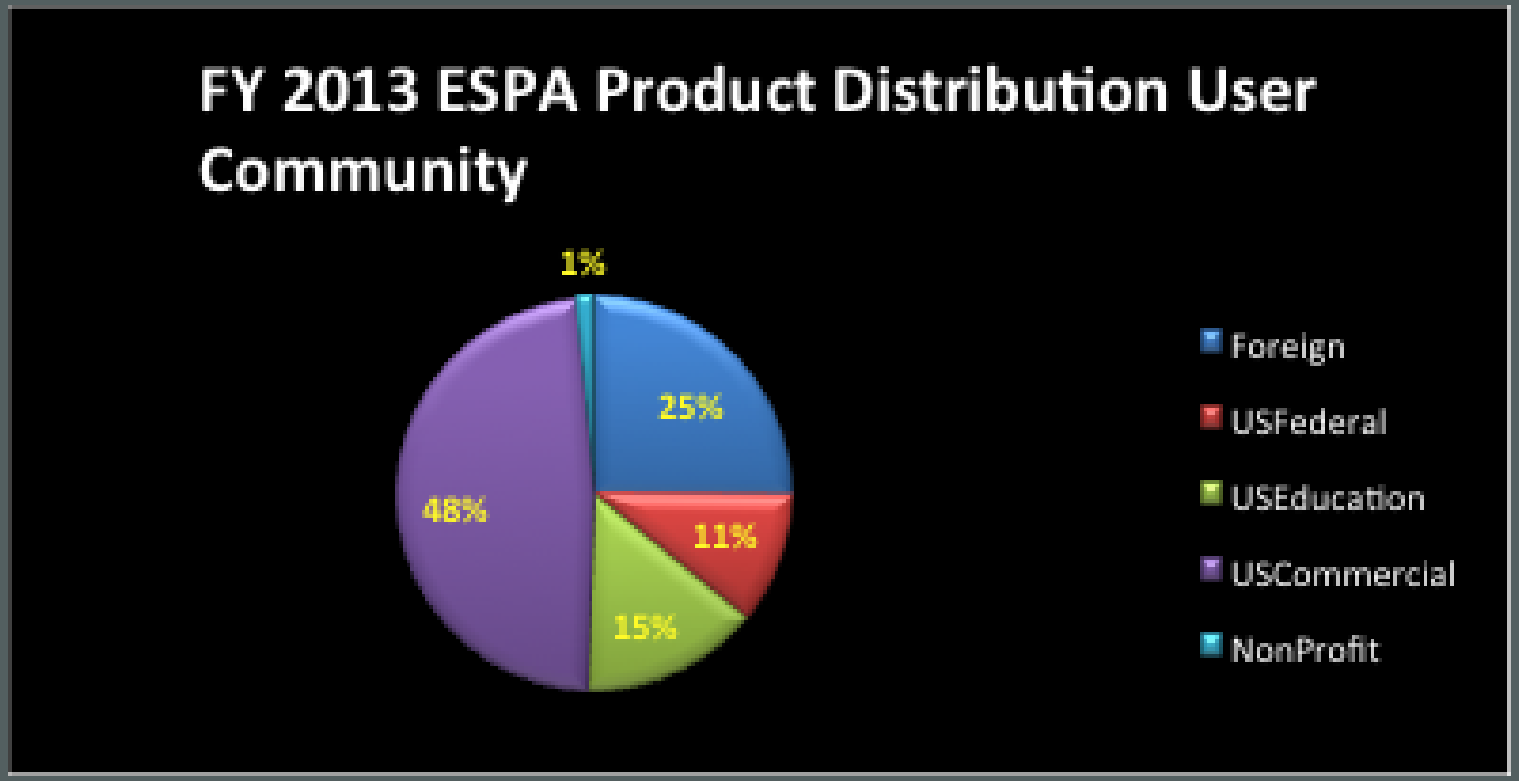
User Characterization



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Burned Area

Classification algorithm:

- *Burned probability surfaces filtered using thresholds and region growing algorithm*
  - *Identifies seed locations using high probability threshold and minimum patch size*
  - *Region growing initiated at seed locations*
  - *Neighboring pixels are added using a second, lower probability threshold*

Individual layers:

- *Burned probability (0-100) and burn classification (0 or 1) layers with QA masks*

Annual summary layers:

- *Burned probability and classification layers summarized for a calendar year*
- *Maximum probability, first date of observed burn, number of observed burns, number of non-cloudy observations*
-

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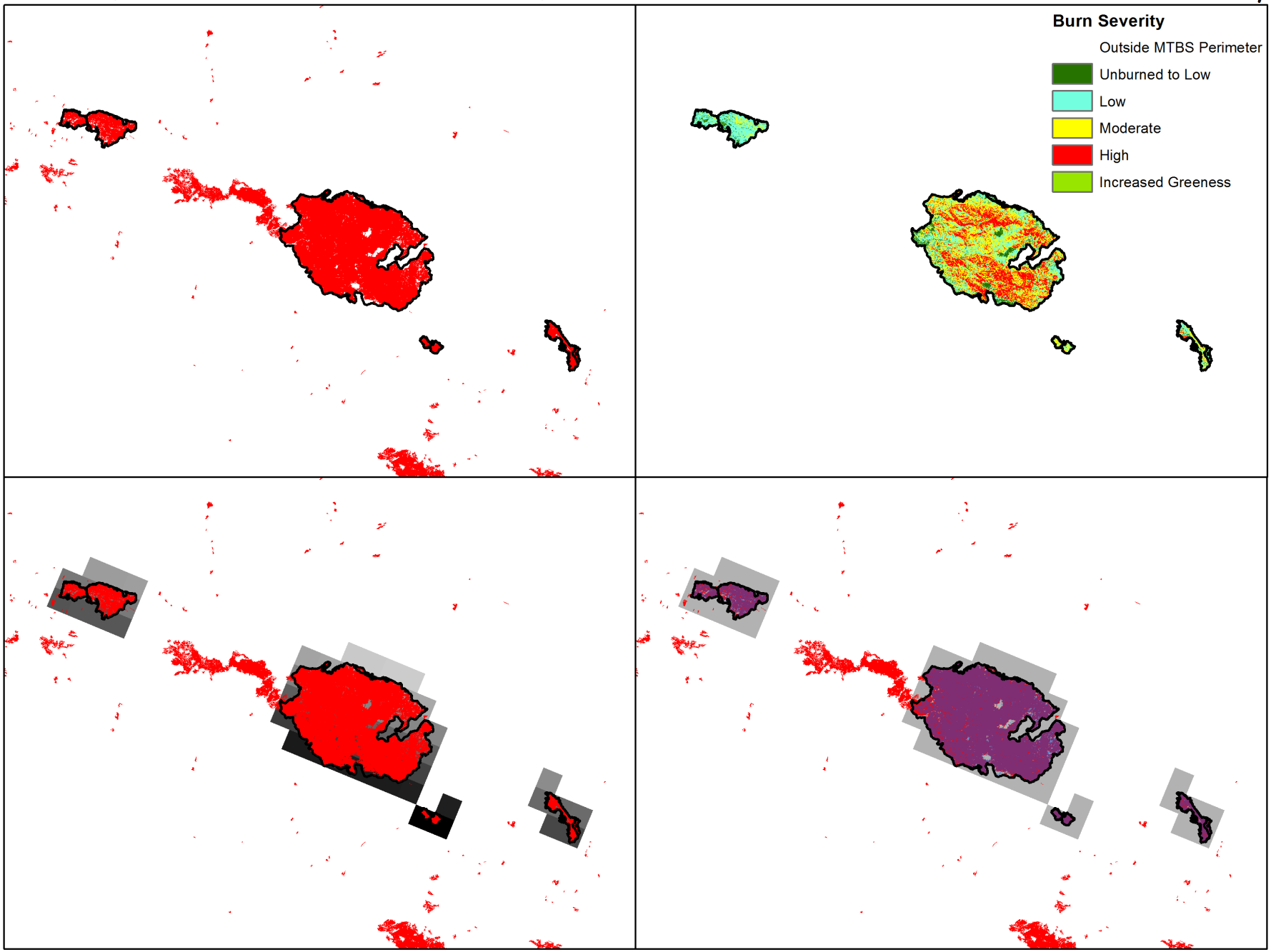
Area classified as burned in 2009

California path 41 row 36 - 2009 Arid West

MTBS Burn Severity



5 km grid for validation

Red-BA Blue-MTBS Purple-both

Product uncertainties/validation

Path 41 Row 36 --- Year 2009

		MTBS	
		Burned	No Data
ECV	Burned	760,732	56,486
	No Data	23,694	881,866

- **Accuracy = 95%**
- **Omission Error = 7%**
- **Commission Error = 3%**

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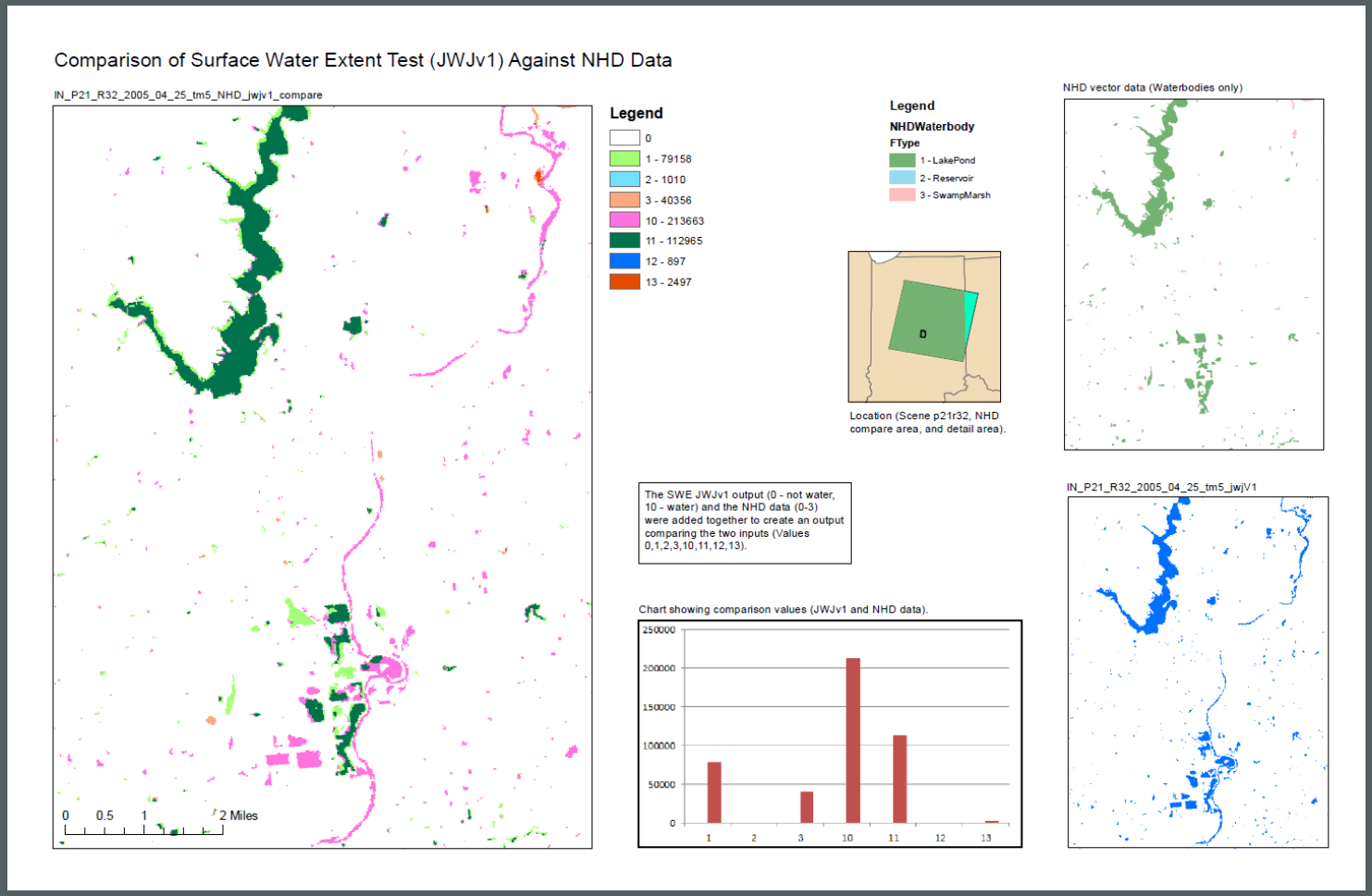
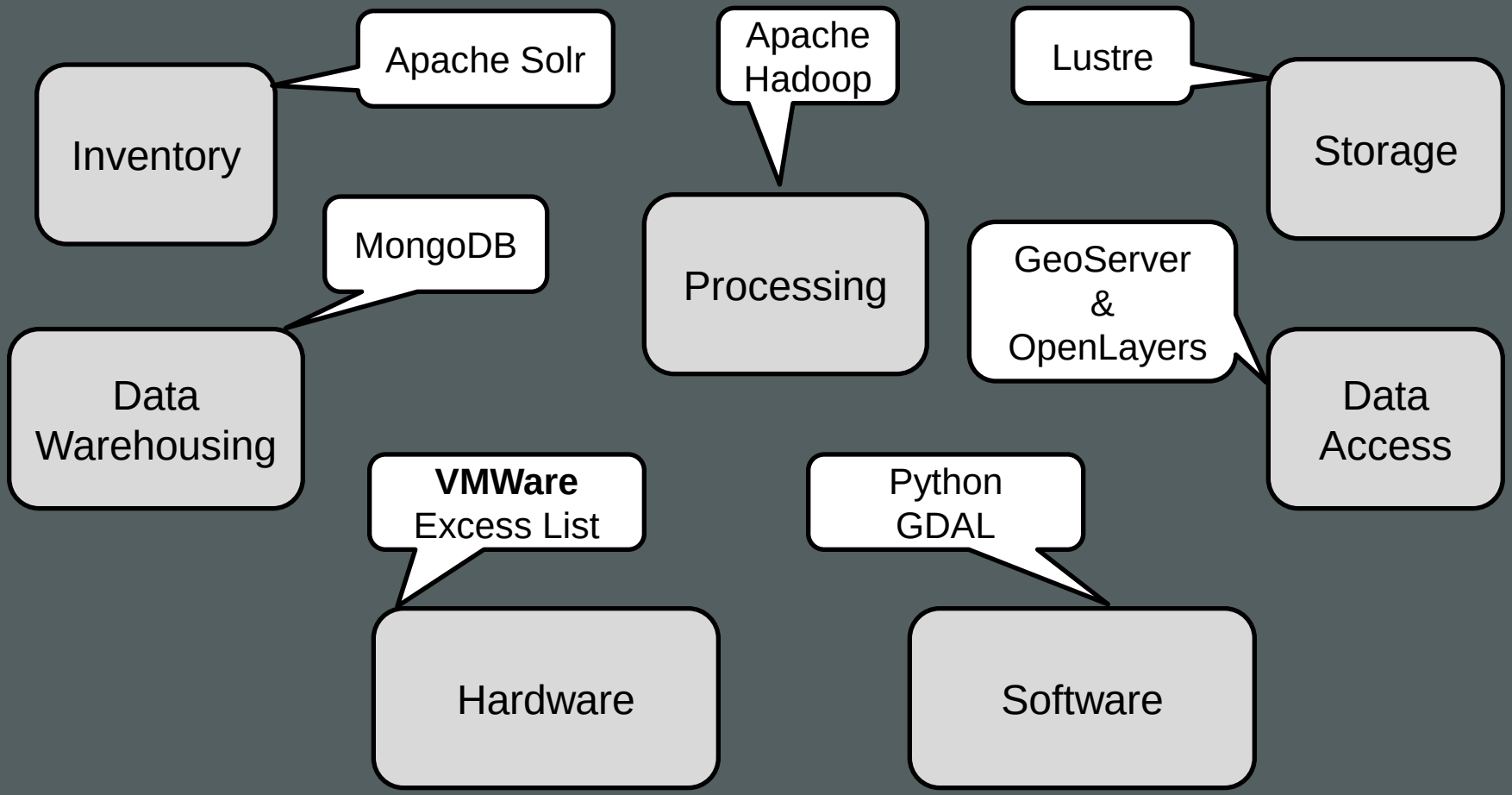
Surface Water Extent



ESPA All Open Source! almost…



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